



A review of taxonomic inventory of vegetable amaranths in Ghana and an outlook on characterization of local amaranth species for farmers

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Introduction

Background

- ◆ The genus *Amaranthus* constitute about 70 species with worldwide distribution (Achigan-Dako et al., 2014).
- ◆ They can be grouped as grain, vegetables, ornamentals and weed (Achigan-Dako et al., 2014, Brenner et al., 2000).
- ◆ Leaves of the various types can be used as vegetables based on regional preference (Das, 2016; Andini et al., 2013)
- ◆ Common species of vegetable amaranths include *A. tricolor*, *A. blitum*, *A. dubius*, *A. cruentus*, *A. viridis* and *A. graecizans* (Das, 2016).

Motivation

- ◆ Despite the high nutritional value, climatic adaptability, low production cost (Achigan-Dako et al. 2014) and comparatively high market value among other indigenous leafy vegetables in Ghana (Nyadanu et al., 2016; Osei-Kwarteng and Mahunu, 2012), there is no publication on the inventory of taxonomically characterized *Amaranthus* spp. in Ghana.
- ◆ This is because, generally minor crops such as indigenous/traditional leafy vegetables are inadequately characterized and neglected by research and conservation in Ghana.
- ◆ Consequently, they are not often reported in germplasm databases and herbaria (Nyadanu et al., 2016).
- ◆ An inventory on taxonomically characterized amaranths will establish handy information to aid further research on the collection, identification, characterization, breeding and development of more climate resilient varieties and hybrids, preservation, and effective utilisation of amaranths in Ghana (Gerrano et al 2017; Nyadanu et al., 2016; Devi et al., 2015) of vegetable amaranths in Ghana.

Research purpose

- ◆ Give a preliminary inventory of vegetable *Amaranthus* species originating and or characterized in Ghana.
- ◆ Review methods of characterizing germplasm of amaranths and summarize their application to advance local characterization of vegetable amaranths in Ghana.

Methodology

- ◆ A combination of the keywords, **Ghana, Amaranthus, Amaranthus L, Origin, Characterization, vegetable amaranths, amaranths, and characterized** were used in various phrases to search for information.
- ◆ Sources of literature- **Scientific search engines** (Web of Science, Science Direct, Agricola, Scopus, Google Scholar) & **databases/genebanks/herbaria** (European cooperative Programme for Plant Genetic Resources (ECP-GR), GRIN-Global Portal (U.S National Plant Germplasm System), Plant Genetic Resources Research Institute (PGRRI) Ghana, Global Biodiversity Information Facility (GBIF), Ghana Biodiversity Information Facility (GhaBIF), AVRDC Vegetable Genetic Resources Information System (AVGRIS), Ghana Herbaria; Ghana herbarium (GhaBIF) University of Ghana (GC), Kwame Nkrumah University of Science and Technology (KUU), University of Cape Coast (CCG), Savannah (University for Development Studies, Herbariorum Index (New York Botanical Garden Steere herbarium).

Acknowledgement

We acknowledge the absence of some citations in the text not listed in the reference section due to space limitation.

Results

1. Data sources & *Amaranthus* spp of Ghana

- ◆ Four databases had *Amaranthus* spp. from Ghana
- ◆ 1) Global Biodiversity Information Facility (GBIF, 114), Ghana Biodiversity Information Facility (GhaBIF-Ghana herbarium, 30), AVRDC Vegetable Genetic Resources Information System (AVGRIS, 18) and GRIN-Global Portal (631) (Figure 1).

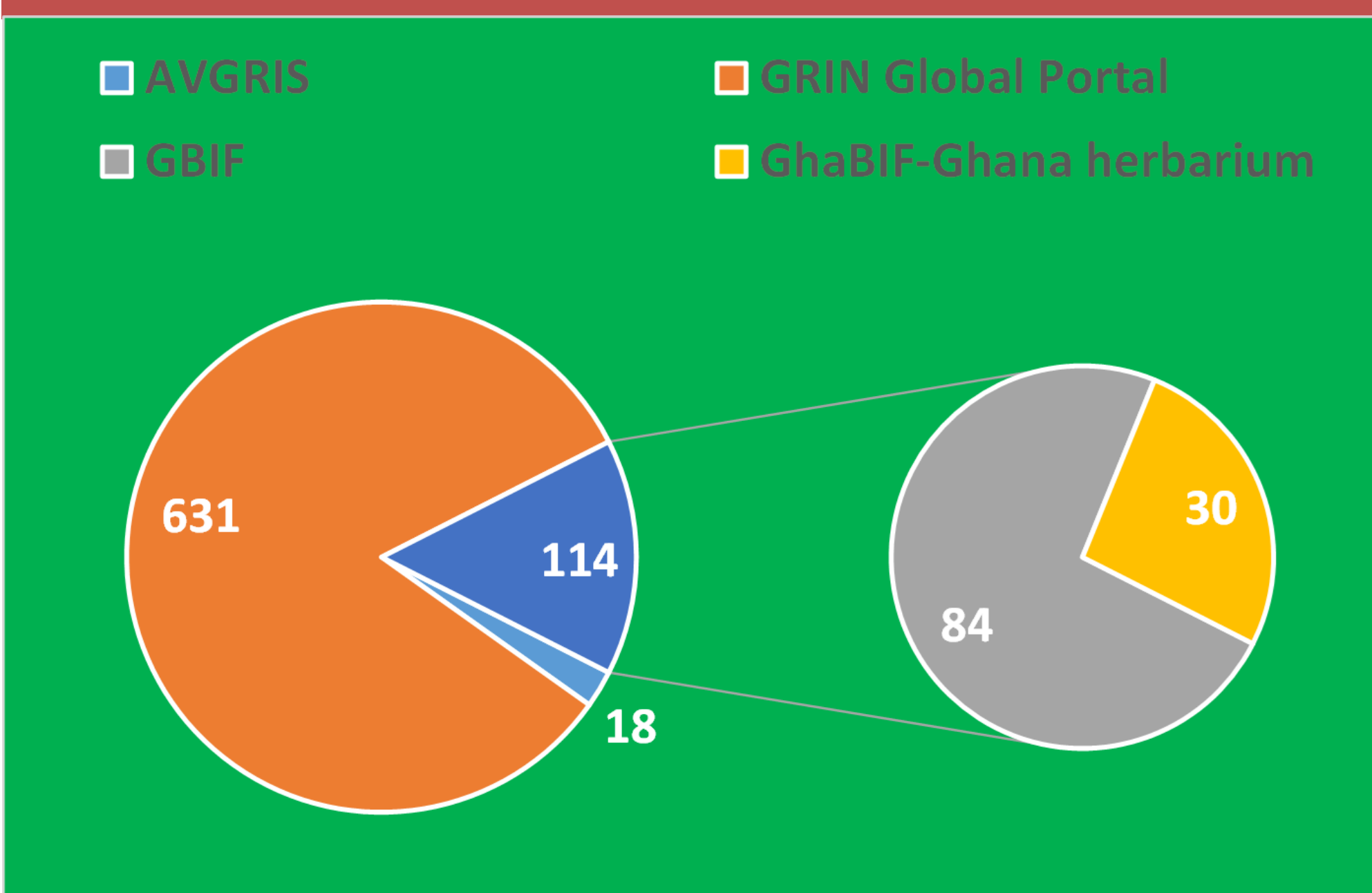


Figure 1. Databases and occurrences of *Amaranthus* spp originating from Ghana; Sources:GRIN-Global Portal 2021 <https://grin.gov/gringlobal/search>; GBIF, <https://www.gbif.org/>

Table 1. Taxonomy and status of 23 amaranth accessions from Ghana in GRIN-Global Portal

| No. | Accessions | Name | Taxonomy | Improvement Status |
|-----|------------|---------------|----------------------------------|--------------------|
| 1 | PI693895 | 'Baneku 13' | <i>A. cruentus</i> L. | Cultivar |
| 2 | PI690544 | RRC 54A | <i>A. cruentus</i> L. | Landrace |
| 3 | PI690545 | RRC 1001 | <i>A. hybr.</i> | Breeding |
| 4 | PI693887 | 'Yendi 15' | <i>A. cruentus</i> L. | Cultivar |
| 5 | PI693888 | 'Guri 170' | <i>A. cruentus</i> L. | Cultivar |
| 6 | PI693889 | 'Amidsysh 18' | <i>A. cruentus</i> L. | Cultivar |
| 7 | PI693890 | 'Yendi 16' | <i>A. cruentus</i> L. | Cultivar |
| 8 | PI693891 | 'Nandom 10' | <i>A. cruentus</i> L. | Cultivar |
| 9 | PI693892 | 'Efari 5' | <i>A. cruentus</i> L. | Cultivar |
| 10 | PI693893 | 'Kumeti 3' | <i>A. cruentus</i> L. | Cultivar |
| 11 | PI693894 | Baneku 12' | <i>A. cruentus</i> L. | Cultivar |
| 12 | PI693895 | 'Baneku 13' | <i>A. cruentus</i> L. | Cultivar |
| 13 | PI693896 | 'Baruku 13' | <i>A. cruentus</i> L. | Cultivar |
| 14 | PI693897 | RRC 40 | <i>A. cruentus</i> L. | Cultivated |
| 15 | PI693898 | RRC 41 | <i>A. cruentus</i> L. | Cultivated |
| 16 | PI693899 | RRC 59 | <i>A. cruentus</i> L. | Cultivated |
| 17 | PI693900 | RRC 60 | <i>A. cruentus</i> L. | Landrace |
| 18 | PI693901 | RRC 62 | <i>A. cruentus</i> L. | Cultivated |
| 19 | PI693902 | RRC 64 | <i>A. cruentus</i> L. | Cultivated |
| 20 | PI693903 | RRC 65 | <i>A. cruentus</i> L. | Cultivated |
| 21 | PI693904 | RRC 665 | <i>A. cruentus</i> L. | Uncertain |
| 22 | PI693906 | Noudom 11' | <i>A. dubius</i> Mart. ex Thell. | Cultivar |
| 23 | PI693907 | RRC 61 | <i>A. dubius</i> Mart. ex Thell. | Wild |

Figures 2 a, & b. Images of “Yendi 15” & Noudom 11 accessions originating from Ghana.



Fig. 2a. Yendi 15 - *A.cruentus*

Source:GRIN-Global Portal 2021 <https://grin.gov/gringlobal/search>

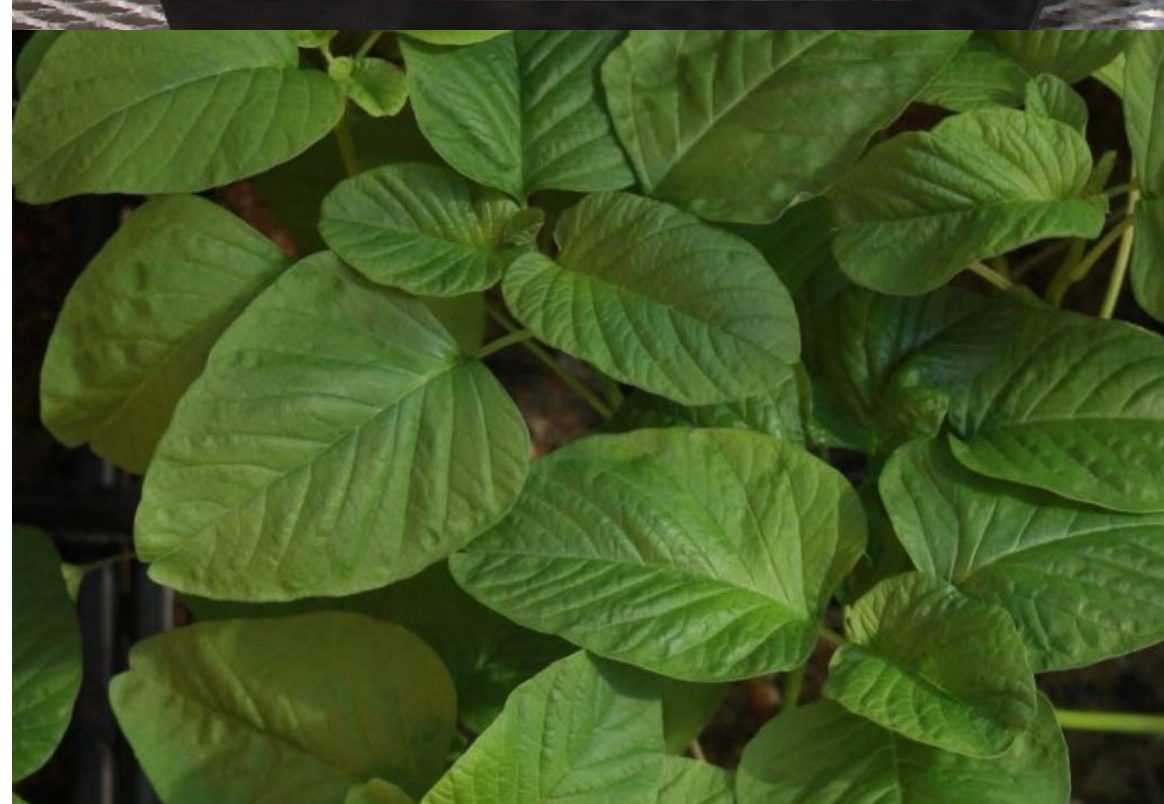


Fig. 2b. Noudom 11 - *A. dubius*

References

- ◆ Achigan-Dako, E.G., Sogbohossou, O.E.D. & Maundu, P. Current knowledge on *Amaranthus* spp.: research avenues for improved nutritional value and yield in leafy amaranths in sub-Saharan Africa. *Euphytica* **197**, 303–317 (2014).
- ◆ Asase, A. & Peterson, A. T. Completeness of Digital Accessible Knowledge of the Plants of Ghana. *Biodiversity Informatics*, **11**: 1-11 (2016).

Characterisation of *Amaranthus* spp in GRIN-Global Portal.

Descriptors: Morphology (12), phenology (daptation for seed maturity), growth (Plant height), production (male sterility & hundred seed weight), and chemical (seed starch type).

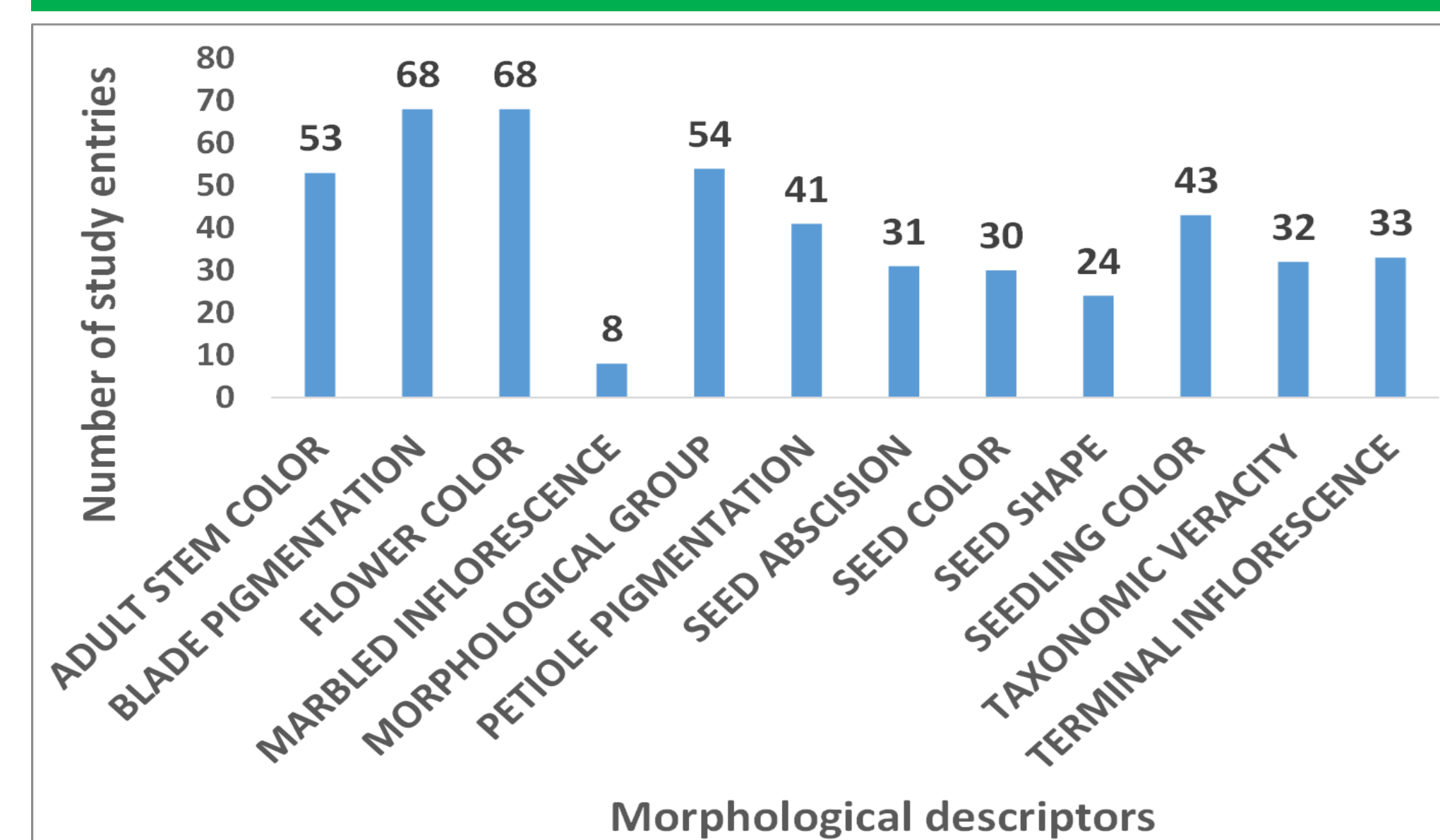
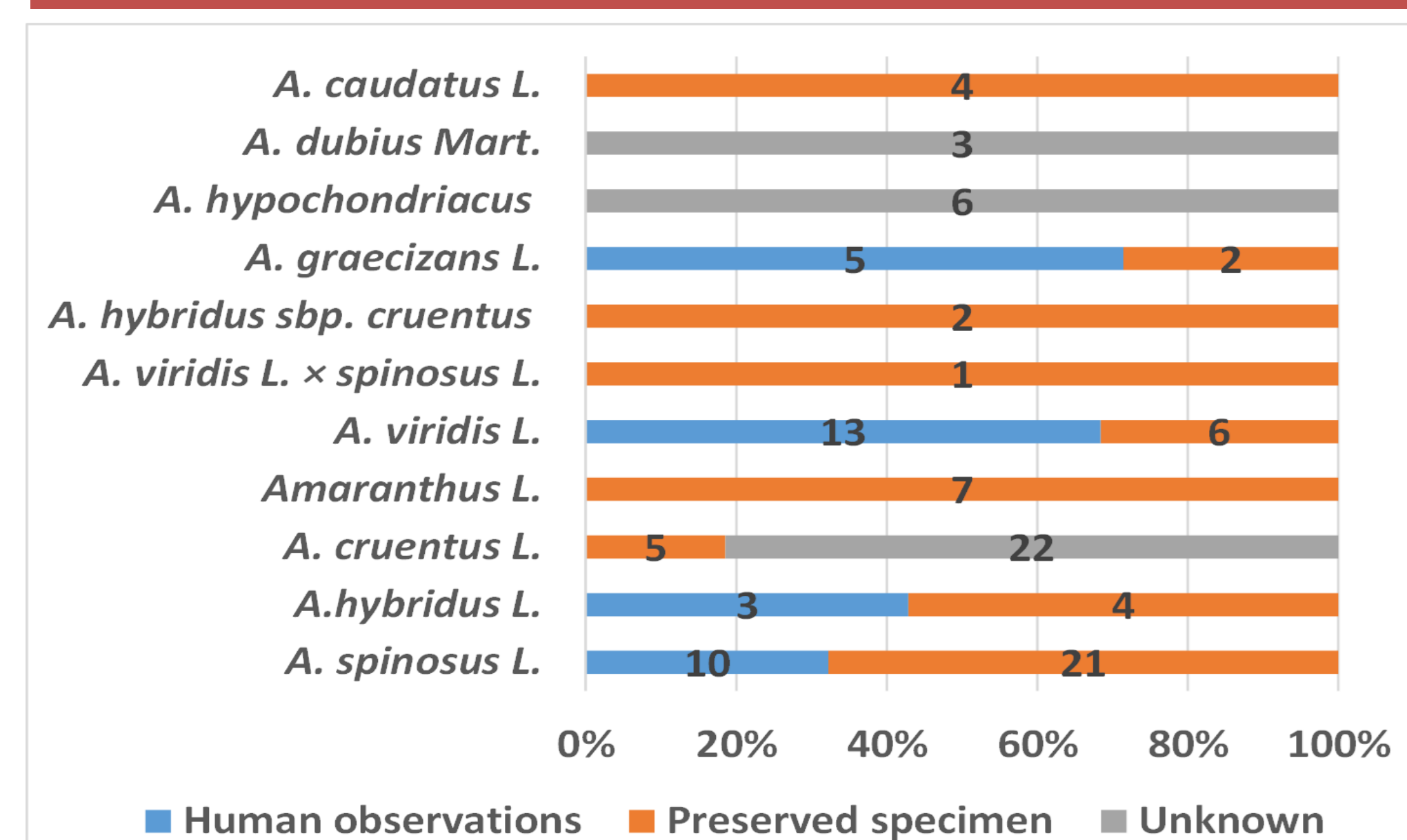


Figure 3. Distribution of morphological descriptors , 485 entries for 23 amaranthus accessions originating from Ghana.

Global Biodiversity Information Facility (GBIF):Dataset characteristics of 11 *Amaranthus* spp.(114 occurrences) recorded



AVRDC Vegetable Genetic Resources Information System (AVGRIS)

- ◆ Out of the 18 occurrences of *Amaranthus* spp originating from Ghana ; *A. hypochondriacus* (11), *A. cruentus* (6) and *A. dubius* (1). These accessions were characterised in 2010 (*A. cruentus*) and 2000 (*A. hypochondriacus* & *A. dubius*) (AVGRIS, 2015).

2. Methods of Characterizing *Amaranthus* spp.

- ◆ Common approaches of characterizing amaranths include; **morphological, chemical, physiological descriptors and analysis (principal component and cluster analysis)**. Biometrical and quality characters are observed experimentally (Kiruthika et al., 2019; Xavier et al 2019; Stoilova et al., 2015; Celine, 2007). Additionally, **molecular based analyses** are further used to offset the limitations of morphological and biochemical trait-based approaches (Akin-Ildowu et al., 2016).

Discussion

- ◆ Among the three main sources of dataset the GRIN Global Portal and AVGRIS provide an advance and robust description of the *Amaranthus* spp. from Ghana.
- ◆ The Global Biodiversity Information Facility database includes information from herbaria from Ghana, however the individual herbarium websites are not active now.
- ◆ This is in concurrence with Asaase et al (2016) who emphasized the need of providing comprehensive information on biodiversity of plants species in Ghana.

Conclusion

- ◆ With the knowledge on the existing taxonomic inventory and characterization methods, field investigations for the collection, identification, characterization and preservation of local/farmer *Amaranthus* spp. for herbaria and further breeding can be advanced in Ghana.

Reference

- ◆ Asase A (2018). Plants of Ghana. Ghana Herbarium. Occurrence dataset <https://doi.org/10.15468/e8rhqm> accessed via GBIF.org on 2021-01-24